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**Yamashita**

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(54) **APPARATUS INCLUDING MOVABLY PROVIDED COVER**

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Jun. 24, 2013 (JP) ..... 2013-131661

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***G03G 21/00*** (2006.01)
***G03G 21/16*** (2006.01)

(52) **U.S. Cl.**
CPC ..... ***G03G 21/1623*** (2013.01); ***G03G 21/1633*** (2013.01); *G03G 2215/0177* (2013.01)

(58) **Field of Classification Search**
CPC ..... G03G 21/1623; G03G 21/1633
USPC ..... 399/110, 111
See application file for complete search history.

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(57) **ABSTRACT**

An apparatus includes a cover including a protrusion and provided to be movable, and an abutment unit provided to be capable of abutting the protrusion and including a second member for applying a force to a first member of an image forming apparatus. The abutment unit includes a first surface which abuts the protrusion in a case where the cover is shifted from an opened state to a closed state and a second surface which abuts the protrusion in a case where the cover is shifted to the closed state after having abutted the first surface, and the protrusion is applied a force from a rotational force of the abutment unit when the protrusion abuts the second surface, and the second member of the abutment unit applies a force to the first member when the cover is in the closed state.

**19 Claims, 8 Drawing Sheets**

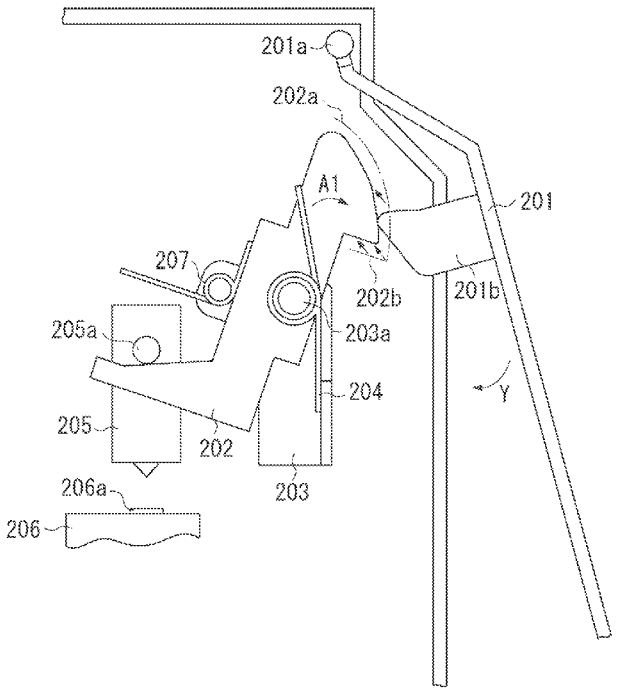


FIG. 1

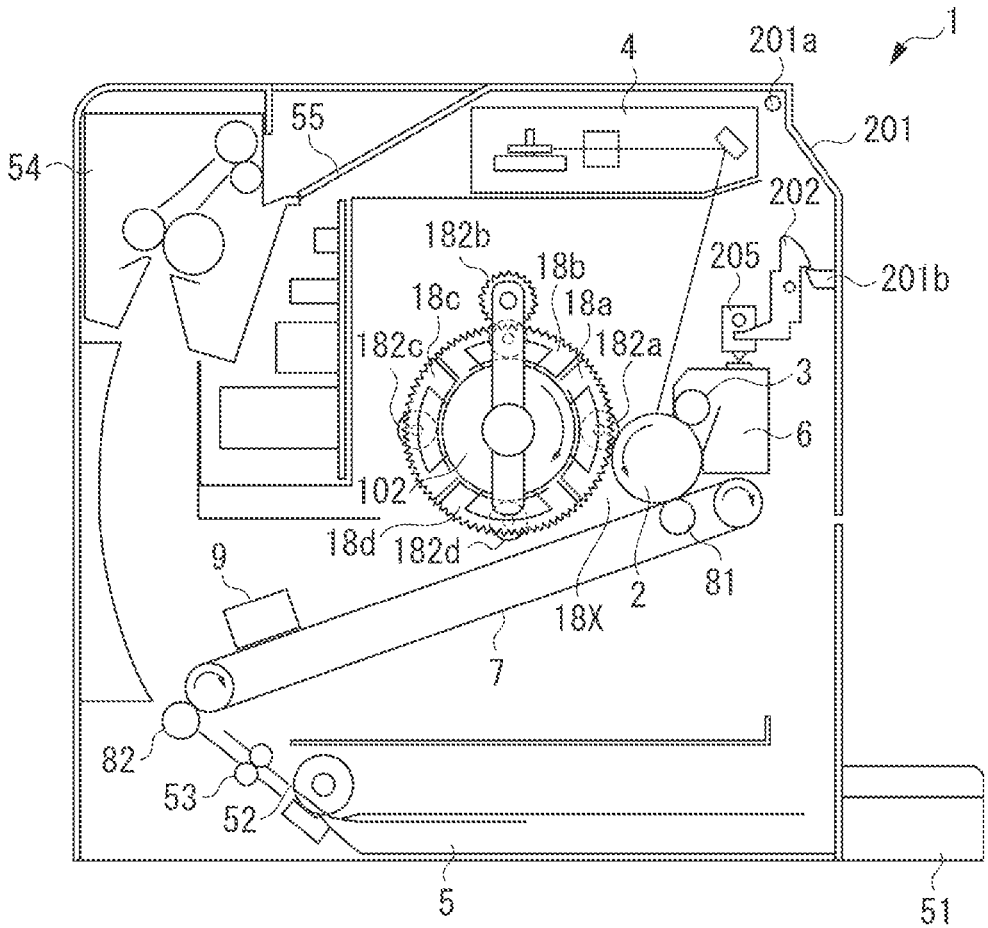

1
4
201a
201
55
54
202
182b
18b
205
201b
18c
18a
182c
182a
3
6
102
18d
182d
9
2
81
18X
7
82
53
52
5
51

FIG. 2

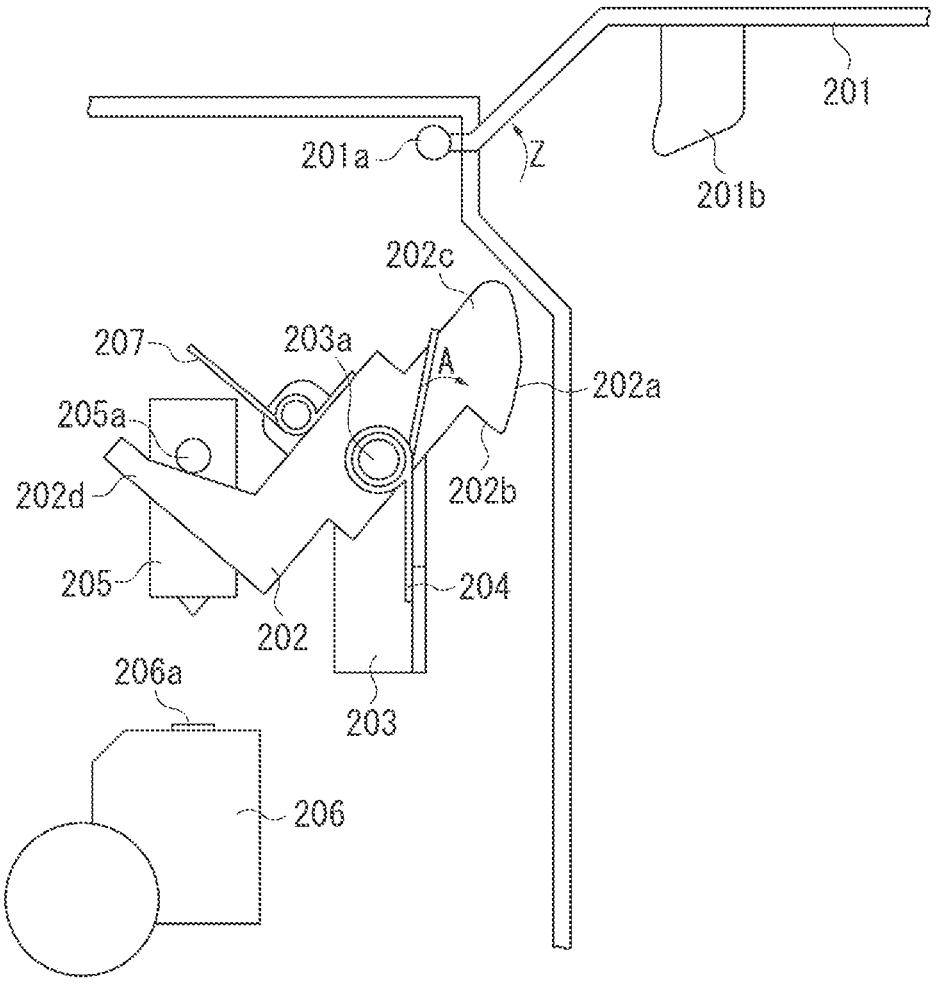

201
201a
Z
201b
202c
207
203a
A
202a
205a
202d
202b
205
204
202
206a
203
206

FIG. 3

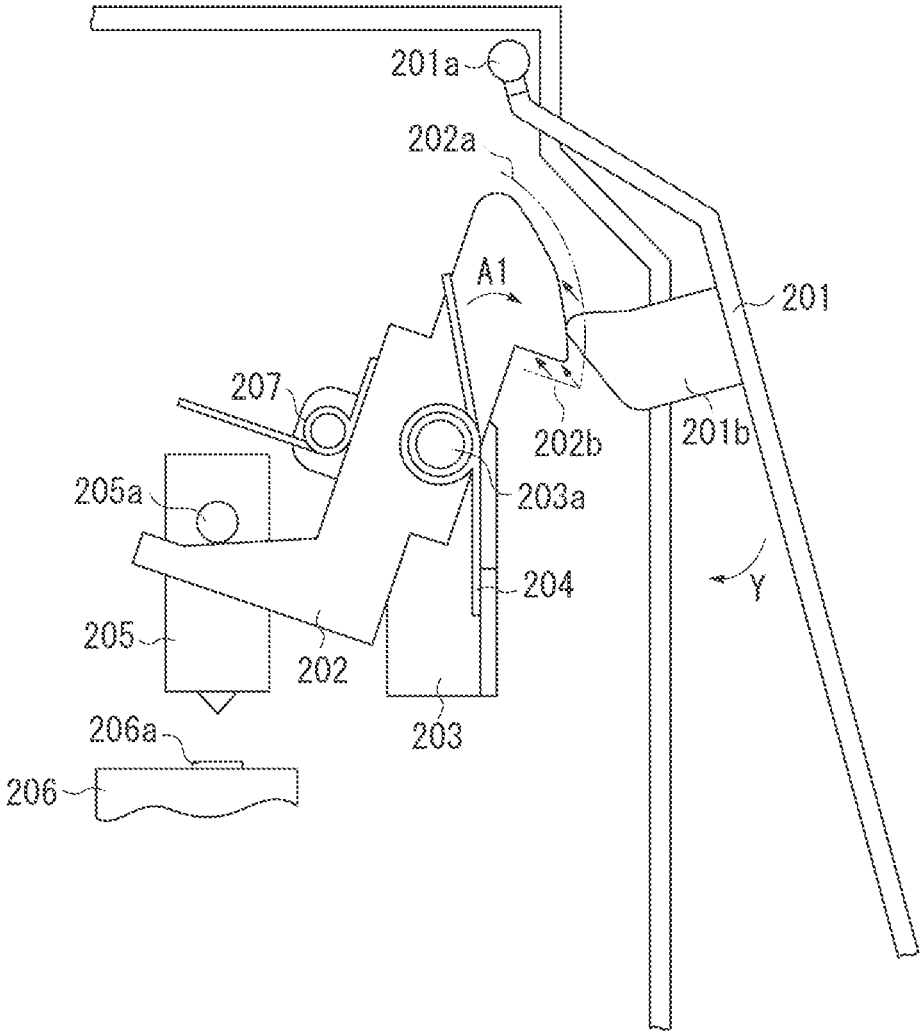

201a
202a
A1
201
207
202b
201b
205a
203a
204
Y
205
202
206a
203
206

FIG. 4

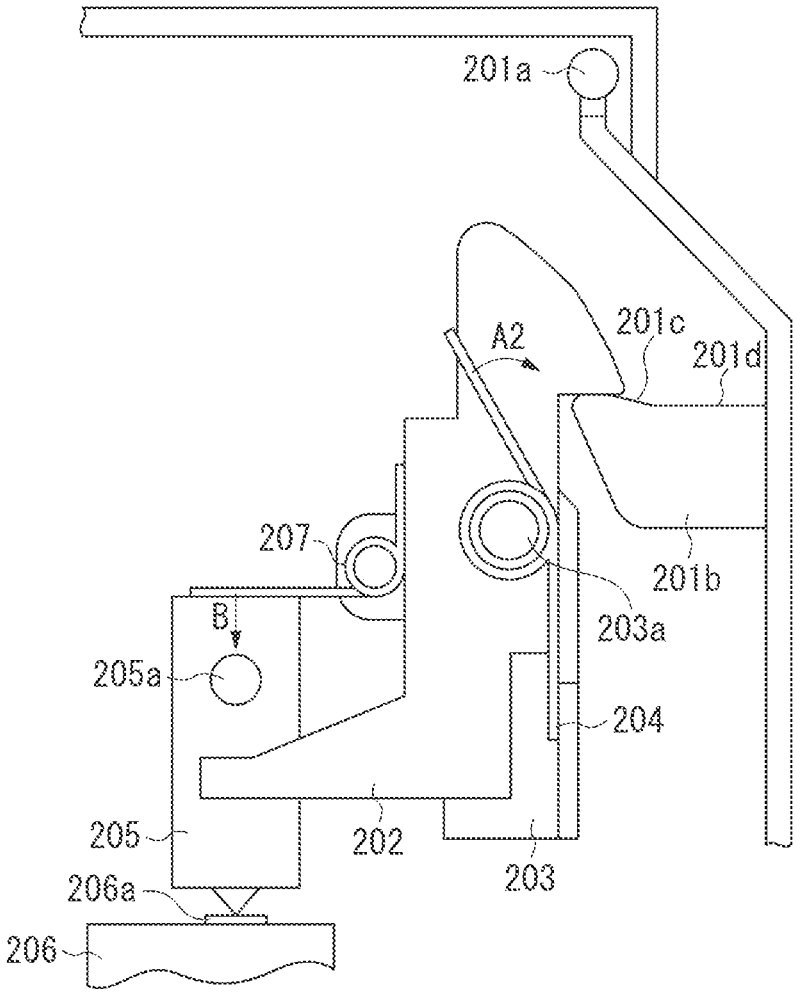


FIG. 5

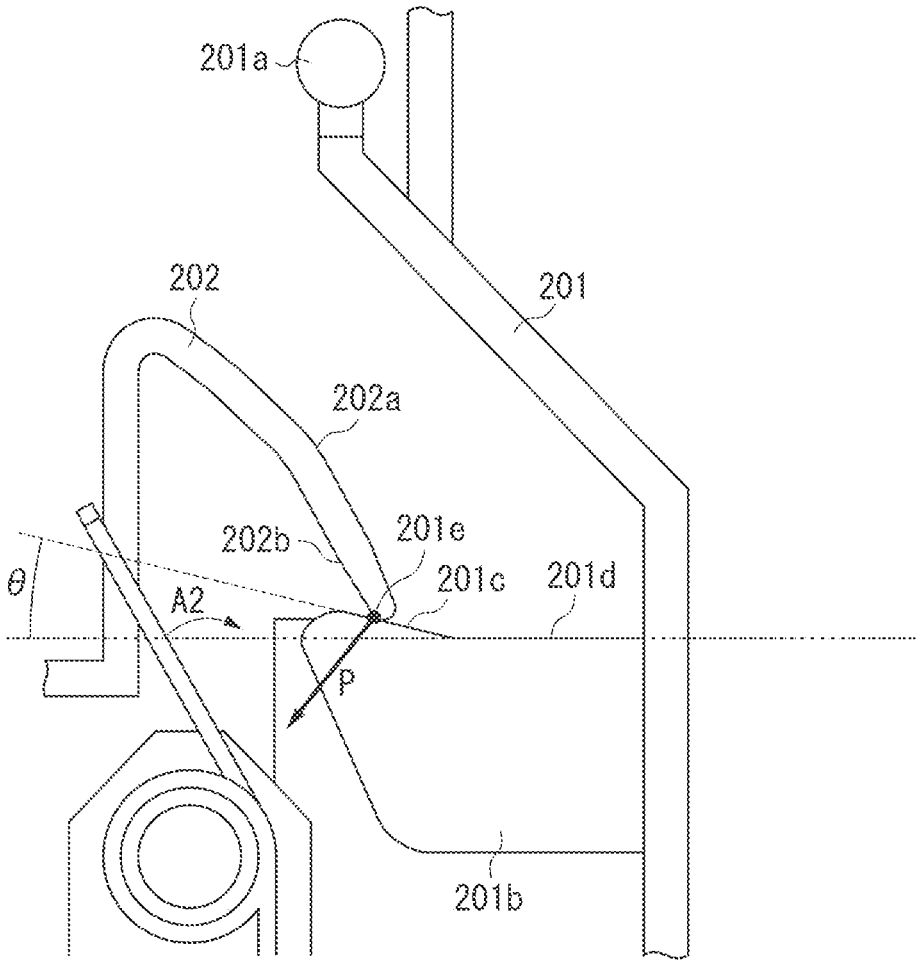


FIG. 6

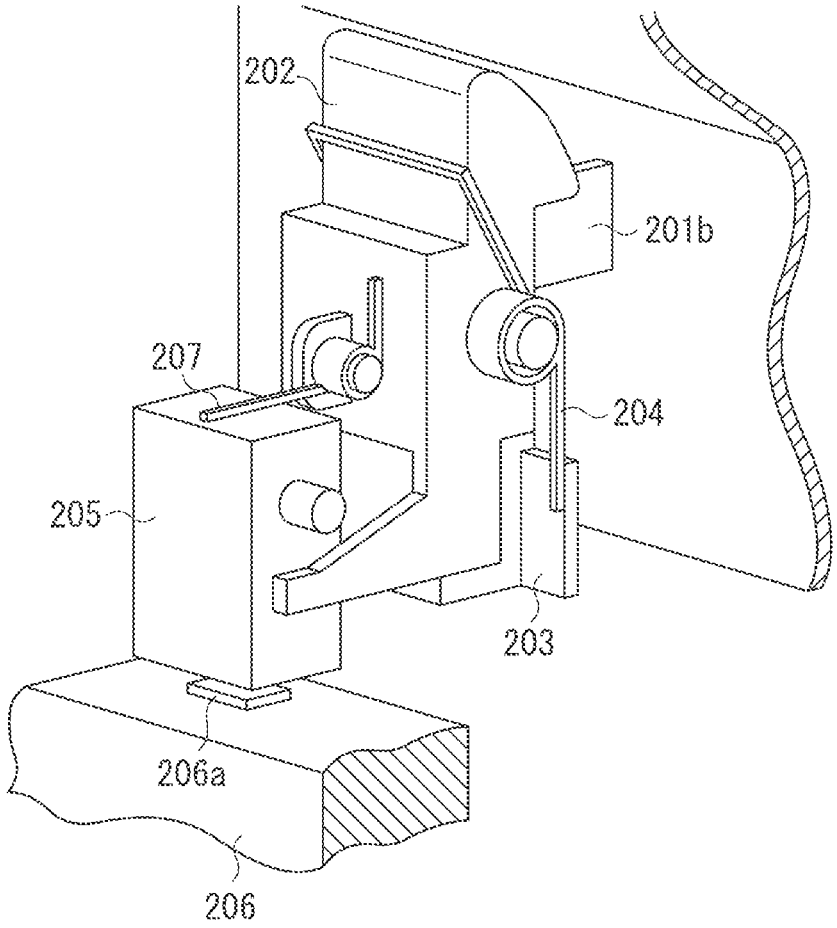


FIG. 7

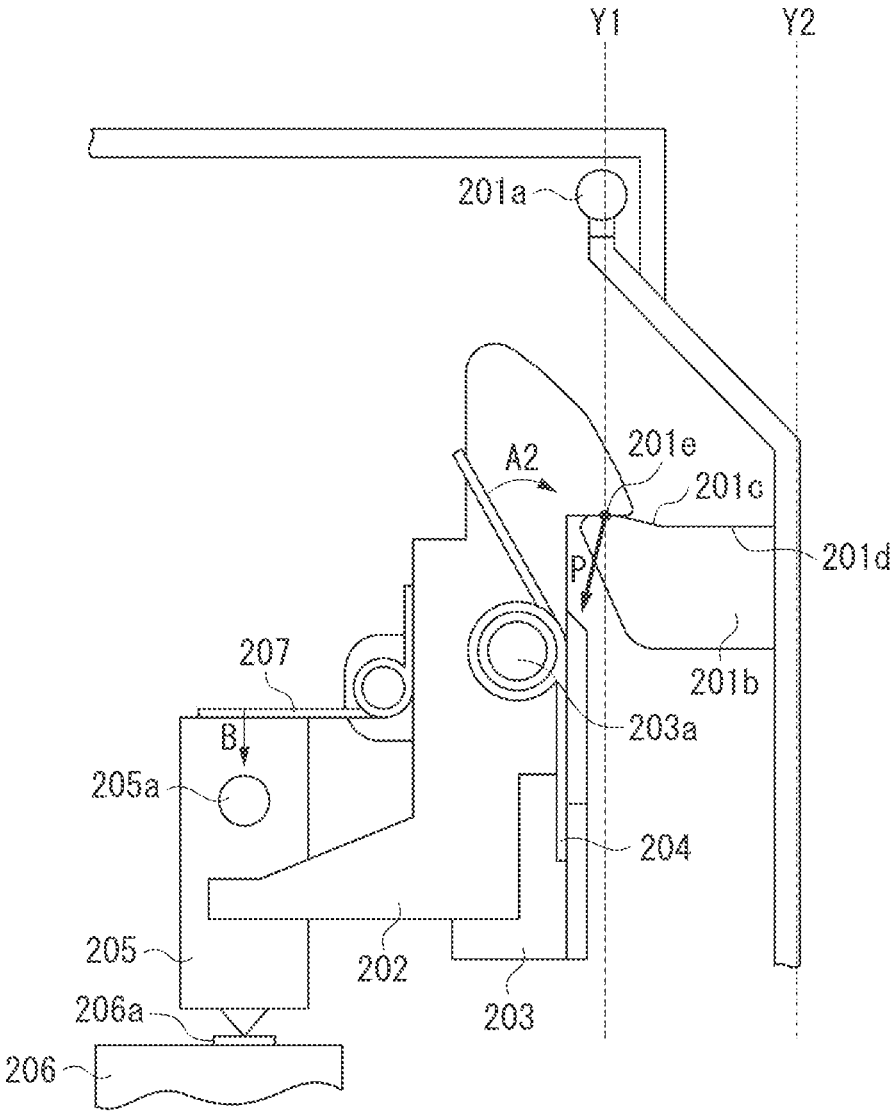

Y1
Y2
201a
A2
201e
201c
201d
P
207
201b
B
203a
205a
204
205
202
203
206a
206

FIG. 8A

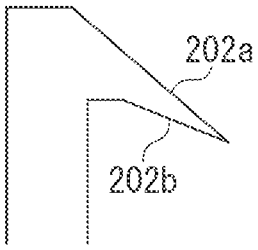



FIG. 8B

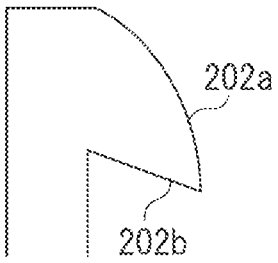
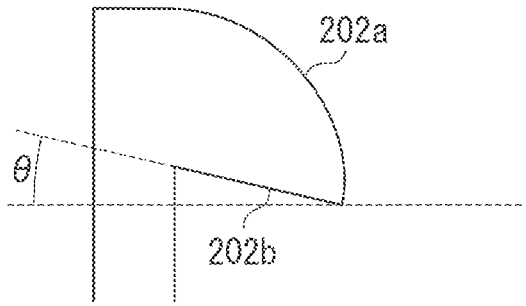



FIG. 8C



# APPARATUS INCLUDING MOVABLY PROVIDED COVER

## BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an apparatus including a movably provided cover, in particular, an image forming apparatus including a movably provided cover, such as a copying machine, a laser beam printer, and a facsimile.

2. Description of the Related Art

Conventionally, an electrophotographic image forming apparatus that forms an image on a recording medium with use of an electrophotographic image forming process have been known as an image forming apparatus. In many cases, an electrophotographic image forming apparatus employs a process cartridge method in which an integrated cartridge including an electrophotographic photosensitive member, a charging unit, and other members for forming electrophotographic images is provided to be attachable to and detachable from a body of the electrophotographic image forming apparatus.

When an electrophotographic image forming apparatus employs the process cartridge method, a process cartridge and a body of the electrophotographic image forming apparatus exist as separate members. Thus, some electrophotographic image forming apparatuses include a storage medium provided to the process cartridge to enable more appropriate operation. This configuration necessitates providing the apparatus body with a mechanism for accessing the storage medium of the process cartridge (Japanese Patent No. 04272860).

However, the provision of the mechanism for accessing the storage medium of the process cartridge inside the body of the image forming apparatus as discussed in Japanese Patent No. 04272860 may lead to complication of the image forming apparatus and an increase in the number of parts.

## SUMMARY OF THE INVENTION

The present invention is directed to suppressing an increase in the number of parts.

According to an aspect of the present invention, an apparatus includes a cover including a protrusion and provided to be movable, and an abutment unit provided to be capable of abutting the protrusion and including a second member for applying a force to a first member of an image forming apparatus. The abutment unit includes a first surface which abuts the protrusion in a case where the cover is shifted from an opened state to a closed state and a second surface which abuts the protrusion in a case where the cover is shifted to the closed state after having abutted the first surface, and the protrusion is applied a force from a rotational force of the abutment unit when the protrusion abuts the second surface, and the second member of the abutment unit applies a force to the first member when the cover is in the closed state.

Further features of the present invention will become apparent from the following description of exemplary embodiments with reference to the attached drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a cross sectional view illustrating a schematic configuration of a color laser beam printer as an example of an image forming apparatus.



FIG. **2** is a schematic diagram illustrating an opened state of a cover.

FIG. **3** is a schematic diagram illustrating a transition from an opened state to a closed state of a cover.

FIG. **4** is a schematic diagram illustrating a closed state of a cover.

FIG. **5** is an enlarged view of an abutment portion of a rib and an arm.

FIG. **6** is a perspective view illustrating an example of a schematic structure of an exemplary embodiment.

FIG. **7** is a schematic diagram illustrating a position of an abutment portion of a rib and an arm.

FIGS. **8**A to **8**C each illustrate an example of an end portion of an arm.

## DESCRIPTION OF THE EMBODIMENTS

Various exemplary embodiments, features, and aspects of the invention will be described in detail below with reference to the drawings.

In the following description of exemplary embodiments of the present invention, a color laser beam printer, which is an image forming apparatus, is described. However, the present invention is also applicable to any common apparatus as well as image forming apparatuses including electrophotographic image forming apparatuses.

[1. Image Forming Apparatus]

An image forming apparatus according to an exemplary embodiment is described below. In the following description, a color laser beam printer including four developing devices is used as an example of the image forming apparatus. FIG. **1** is a cross sectional view of the color laser beam printer.

First, an image forming operation of the color laser beam printer will be described.

As illustrated in FIG. **1**, an image forming apparatus **1** includes an electrophotographic photosensitive drum (hereinafter "photosensitive drum") **2** which is an image bearing member. A charging roller **3**, an exposure device **4**, four developing devices **18***a* to **18***d*, and a cleaning device **6** are disposed around the photosensitive drum **2**. The charging roller **3** is a charging unit adapted to uniformly charge the photosensitive drum **2**. The exposure device **4** is an exposure unit adapted to irradiate the photosensitive drum **2** with laser beams corresponding to image information. The charged photosensitive drum **2** is irradiated with the laser beams, so that an electrostatic latent image is formed on the photosensitive drum **2**. Each of the developing devices **18***a* to **18***d* is a developing unit adapted to develop the electrostatic latent image formed on the photosensitive drum **2** with a developer of a corresponding color so that the electrostatic latent image is visualized.

The developing device **18***a* is a yellow developing device which stores a yellow developer to develop an electrostatic latent image with the yellow developer. The developing device **18***b* is a magenta developing device which stores a magenta developer to develop an electrostatic latent image with the magenta developer. The developing device **18***c* is a cyan developing device which stores a cyan developer to develop an electrostatic latent image with the cyan developer. The developing device **18***d* is a black developing device which stores a black developer to develop an electrostatic latent image with the black developer. In other words, the developing devices **18***a* to **18***d* develop an electrostatic latent image formed on the photosensitive drum **2**.

The cleaning device **6** is a cleaning unit adapted to remove a residual developer remaining on a surface of the photosensitive drum **2**.

The photosensitive drum **2** is rotated in a direction of an arrow indicated in FIG. **1** (rotated counterclockwise) in synchronization with a rotation of an intermediate transfer belt **7**. The charging roller **3** uniformly charges the surface of the photosensitive drum **2**. Then, the exposure device **4** irradiates the photosensitive drum **2** with light corresponding to a yellow image to form a yellow electrostatic latent image on the photosensitive drum **2**.

Concurrently with the formation of the electrostatic latent image, a drive transmission mechanism rotates a rotary member **102**. The rotary member **102** is a rotatable supporting member which rotates and supports the four developing devices **18***a* to **18***d* such that the developing devices **18***a* to **18***d* are attachable to and detachable from the rotary member **102**. Then, the yellow developing device **18***a* is stopped at a development position **18**X facing to the photosensitive drum **2**. At the development position **18**X, the photosensitive drum **2** is in contact with a developing roller **182***a* which is a developer bearing member included in the developing device **18***a*. A voltage with the same polarity as the charging polarity of the photosensitive drum **2** and substantially the same electric potential as the photosensitive drum **2** is applied to the developing roller **182***a* so that the yellow developer adheres to the electrostatic latent image on the photosensitive drum **2**, so that the electrostatic latent image is developed with the yellow developer. More specifically, the rotary member **102** rotates while supporting the plurality of developing devices **18***a* to **18***d* to move the supported developing devices successively one after another to the development position **18**X facing to the photosensitive drum **2**. When positioned at the development position **18**X, each of the developing devices **18***a* to **18***d* develops the electrostatic latent image based on the color of the developer stored therein. According to the present exemplary embodiment, an elastic roller in which a metal shaft is coated with rubber is used as the developing rollers **182***a* to **182***d* serving as the developer bearing members. According to the present exemplary embodiment, each of the developing rollers **182***a* to **182***d* is in contact with the photosensitive drum **2** at the development position **18**X (contact development method). Each of the developing rollers **182***a* to **182***d* develops the electrostatic latent image while being in contact with the photosensitive drum **2**. However, the present invention is not limited to the above-described configuration. The present invention is also applicable to a configuration in which at the development position **18**X, each of the developing rollers **182***a* to **182***d* develops an electrostatic latent image while being in close proximity to but not in contact with the photosensitive drum **2**. Then, a voltage with an opposite polarity to the polarity of the developer is applied to a primary transfer roller **81** disposed inside the transfer belt **7**, so that the yellow developer image formed on the photosensitive drum **2** is primary transferred to the transfer belt **7**.

The primary transfer of the yellow developer image is completed as described above. Then, the magenta, cyan, and black developing devices **18***b* to **18***d* are rotated and moved one after another by the rotating rotary member **102** and stopped at the development position **18**X facing to the photosensitive drum **2**. Then, as in the case of the yellow developer, the formation of an electrostatic latent image, development of the electrostatic latent image, and primary transfer of the developed image are successively performed for the respective magenta, cyan, and black developers. Accordingly, the developer images of the four colors overlap each other on the transfer belt **7**.

During the above-described operations, a secondary transfer roller **82** is not in contact with the transfer belt **7**. At that time, the cleaning unit **9** which removes residual toner remaining on the transfer belt **7** is not also in contact with the transfer belt **7**.

A sheet S as a recording medium is stored in a cassette **51** provided at a lower portion of an apparatus body **90**. A developer image is formed on a recording medium. Examples of a recording medium include a recording sheet, an overhead projector (OHP) sheet, and the like. The sheets S are separated by a feeding roller **52** one by one from the cassette **51** and fed to a pair of registration rollers (conveyance rollers) **53**. The registration roller pair **53** sends the fed sheet S to an area between the transfer belt **7** and the transfer roller **82**. The transfer roller **82** and the transfer belt **7** are in pressure contact with each other (a state illustrated in FIG. **1**).

A voltage with the opposite polarity to the polarity of the developer is applied to the transfer roller **82**, so that the developer images of the four colors overlapping with each other on the transfer belt **7** are collectively transferred (secondary transfer) onto a surface of the conveyed sheet S.

The sheet S on which the developer images have been transferred is sent to a fixing unit **54**. The fixing unit **54** applies heat and pressure to the sheet S to fix the developer images onto the sheet S, so that a color image is formed on the sheet S. Then, the sheet S is discharged from the fixing unit **54** to a discharging unit of an upper cover **55** outside the apparatus body **90**.

[2. Movably Provided Cover]

[State in which Cover is Opened (Opened State)]

The present exemplary embodiment is described in detail below with reference to FIGS. **2** to **6**.

FIG. **2** illustrates a state in which a cover **201** which is freely rotatably fixed to the apparatus body **90** is opened (i.e., an opened state). The cover **201** includes a rib (protrusion) **201***b* on an inner surface of the cover **201**. When a process cartridge **206** is attached or detached, the cover **201** is opened and closed around a rotation fulcrum **201***a*. The cover **201** according to the present exemplary embodiment is not in a planar shape of a flat surface but in a convex shape protruding to the outside (the side opposite to the inside of the image forming apparatus where the photosensitive drum and other members are disposed) the rotation fulcrum **201***a*. When the cover **201** is opened in a direction Z, a storage medium access unit (first member) **205** for writing electric information to a storage medium **206***a* is released from contact with the storage medium **206***a* disposed on the process cartridge **206**. More specifically, the storage medium access unit **205** is lifted by one end portion (lifting end portion) **202***d* of an arm (abutment unit) **202**, so that the storage medium access unit **205** is released from the contact with the storage medium **206***a*. Therefore, the process cartridge **206** can be removed from the apparatus body **90**. The present exemplary embodiment describes the example in which the storage medium is provided to the process cartridge including the image bearing member, however the storage medium may be provided to the developing device **18** including the developer bearing member or to the cleaning device **6**. Alternatively, a storage medium such as a memory may be provided to each of the process cartridge **206**, the developing device **18**, and the cleaning device **6**, and at least one of them may be brought into contact

according to the exemplary embodiment of the present invention. In this case, the rest are brought into contact with use of a different means.

Operations of the storage medium access unit **205** that is performed when the cover **201** is opened is described. The arm **202** is attached to a base **203** fixed to the apparatus body **90** in a manner such that the arm **202** is freely rotatable about a rotation fulcrum **203***a*. The arm **202** is rotated clockwise by a moment A of a rocking torsion spring **204** so that the lifting end portion of the arm **202** lifts a boss **205***a* of the storage medium access unit **205** to separate the storage medium access unit **205** from the storage medium **206***a*.

The other end portion of the arm **202** on the opposite end of the lifting end portion is desirably in a shape of a sickle **202***c*. An external side of the sickle **202***c* is a first surface **202***a*, and an inner side of the sickle **202***c* is a second surface **202***b*. As to a relationship with the rib **201***b*, the arm **202** is provided so as to abut the rib **201***b*. The rib **201***b* frictionally slides on the first surface **202***a* while abutting the first surface **202***a*. After having frictionally slid on the first surface **202***a*, the rib **201***b* abuts the second surface **202***b*.

[State in which Cover is Shifted from Opened State to Closed State]

FIG. **3** illustrates a state of the cover **201** which is freely rotatably fixed to the apparatus body **90** in transition from the opened state illustrated in FIG. **2** to a closed state illustrated in FIG. **4**.

The rib **201***b* formed on the cover **201** rotates the arm **202** about the rotation fulcrum **203***a* of the base **203** fixed to the apparatus body **90** in the opposite direction to the moment A**1**. The rib **201***b* first abuts the first surface **202***a* of the arm **202**. When the cover **201** is pushed further in a direction Y, which is the direction in which the cover **201** is closed from this state (after having abutted), the arm **202** is rotated in the opposite direction to the moment A**1**. As the cover **201** is pushed further in the direction Y, a contact point pushing torsion spring (second member) **207** attached to the arm **202** pushes the storage medium access unit (first member) **205** to bring the storage medium access unit **205** into contact with the storage medium **206***a*.

When the storage medium access unit **205** and the storage medium **206***a* are in contact with each other, not only the moment A**1** of the rocking torsion spring **204** but also a reaction force of a force of the contact point pushing torsion spring (second member) **207** pushing the storage medium access unit (first member) **205** are applied to the arm **202**. As the cover **201** is pushed further in the direction (direction Y) in which the cover **201** is closed, the arm **202** is further rotated and, consequently, an abutment surface where the rib **201***b* abuts the arm **202** is switched from the first surface **202***a* to the second surface **202***b*. The abutment surface is switched, so that a force is applied in the direction (direction Y) in which the cover **201** is automatically closed.

The end portion of the arm **202** that applies a force to the rib **201***b* of the cover **201** and the urging member (second member) **207** which stably applies a force to the storage medium access unit (first member) **205**, are used integrally with the arm **202**. With this configuration, there is no need to separately provide an urging unit (pushing unit) for stabilize a contact point of the storage medium **206***a* and the apparatus body **90**. Thus, the number of parts can be reduced.

It is desirable to use a rib **201***b* including an intersecting surface **201***c* and a parallel surface **201***d* as illustrated in FIG. **4** so that a force is applied to the rib **201***b* to allow the cover **201** to be closed automatically with ease. The parallel surface **201***d* of the rib **201***b* is a surface parallel to the surface on which the apparatus is installed when the cover is in the closed state. The intersecting surface **201***c* of the rib **201***b* is a surface that intersects with the parallel surface **201***d*. It is desirable that the rib **201***b* is designed to include the intersecting surface **201***c* that intersects with the second surface **202***b* of the arm **202** while abutting the second surface **202***b* when the cover **201** is in the closed state. With the rib **201***b* designed as illustrated in FIG. **4** or **5**, the intersecting surface **201***c* of the rib **201***b* and the second surface **202***b* of the arm **202** abut each other when the cover **201** is in the closed state, so that the rib **201***b* is urged by a rotational force from the arm **202** to allow the cover **201** to be closed automatically with ease.

If the intersecting surface **201***c* is not provided, the reaction force of the pushing force of the storage medium access unit **205** causes a force to be applied in the direction in which the cover **201** is opened. As a result, the point at which the cover **201** is closed may become unstable, which may lead to a deteriorated external view or unstable abutment force of the storage medium access unit **205**.

Hence, the intersecting surface **201***c* is provided to improve an external view with reduced instability and lifting of an external cover, improve usability by automatic closing of the external cover, and stabilize the contact point pressure of the storage medium **206***a*.

As illustrated in FIG. **5**, the surface of the rib **201***b* is inclined so as to convert a moment A**2** transmitted by the arm **202** into a vector of a force P at an abutment portion **201***e* where the rib **201***b* and the arm **202** abut each other. The force P rotates the cover **201** about the rotation fulcrum **201***a* in the direction in which the cover **201** is closed. This allows the cover **201** to be closed automatically without requiring a user to completely push the cover **201**.

Meanwhile, a reaction force of the force P is applied to the arm **202** in the direction in which the storage medium **206***a* is pushed further. This allows the storage medium access unit **205** to apply a force to the storage medium **206***a* more stably.

An end portion of the arm **202** is desirably in a shape of a sickle or may have a hollow structure as illustrated in FIG. **5**. Further, even if the end portion of the arm **202** has a filled structure, it is effective as long as the second surface **202***b* of the arm **202** is inclined with respect to the surface on which the apparatus is installed when the cover **201** is in the closed state. For example, the second surfaces **202***b* illustrated in FIGS. **8**A to **8**C are effective. An inclination angle θ of the second surface **202***b* is desirable in a range from 5° to 45°, and a range from 10° to 25° is more desirable. In addition, it is desirable that the first surface **202***a* is a curved surface as illustrated in FIG. **8**C to allow the rib **201***b* to frictionally slide on the first surface **202***a*.

As described above, according to the exemplary embodiment of the present invention, an end portion of an arm for applying a force to a rib of a cover and an urging member (second member) for stably applying a force to a storage medium access unit (first member) are integrally used as the arm. With this configuration, there is no need to separately provide a pushing unit to stabilize the contact point of the storage medium and the apparatus body. Thus, an increase in the number of parts can be suppressed and, depending on the design, the number of parts can be reduced.

[State in which Cover is Closed (Closed State)]

FIGS. **4** and **6** each illustrate a state in which the cover **201** which is freely rotatably fixed to the apparatus body **90** is closed (i.e., a closed state).

The rib **201***b* formed on the cover **201** remains stationary by receiving a moment A**2** after having rotated the arm **202**

about the rotation fulcrum **203***a* of the base **203** fixed to the apparatus body **90** in the opposite direction to the moment A**2**. At this time, the contact point pushing torsion spring (second member) **207** attached to the arm **202** pushes the storage medium access unit (first member) **205** with a force B to apply contact pressure to the contact point where the storage medium access unit **205** and the storage medium **206***a* are in contact with each other.

[3. Abutment Position of Rib and Arm]

As illustrated in FIG. **7**, the rib **201***b* abuts the arm **202** at the abutment portion **201***e*. According to the present exemplary embodiment, the abutment portion **201***e* is positioned at the downstream side of the rotation fulcrum **201***a* of the cover **201** in the direction of gravity (Y**1**). To further stabilize the closing position of the cover **201**, the rotation fulcrum **201***a* may be provided at a position closer to a position Y**1** than to a position Y**2**, and the rib **201***b* can be applied a force more effectively.

When the gradient of the vector of the force P is inclined toward the inside of the apparatus from the direction of gravity, a force is effectively applied to the rib **201***b*. Thus, for example, the inclination of the intersecting surface **201***c* of the rib **201***b* may be increased. Although it can be effective to incline the intersecting surface **201***c* at an angle θ indicated in FIG. **5** of 2° or 3° with respect to the horizontal surface **201***d*, it is desirable to incline the intersecting surface **201***c* at 5° to 45°, more desirably 10° to 25°. Alternatively, the shape of the sickle of the arm may be modified to further incline the vector of the force P.

[4. Other Applications, etc.]

According to the above-described exemplary embodiment, the arm includes the urging member (second member) provided to apply a force to the storage medium access unit. However, a target to be urged according to exemplary embodiments of the present invention is not limited to the storage medium access unit. For example, an urging member may include a mechanism for transmitting and receiving electric signals to and from an apparatus body, so that the urging member can directly apply a force to a storage medium to establish an electrical connection. Further, an urging member may apply a force to a laser shutter provided to avoid unnecessary exposure so that laser light can reach an area to be exposed. Furthermore, an urging member may apply a force to a door switch.

The present invention can provide an apparatus with a movably provided cover that uses parts integrally to avoid an increase in the number of parts, compared with conventional apparatuses.

While the present invention has been described with reference to exemplary embodiments, it is to be understood that the invention is not limited to the disclosed exemplary embodiments. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures and functions.

This application claims the benefit of Japanese Patent Applications No. 2012-196871 filed Sep. 7, 2012 and No. 2013-131661 filed Jun. 24, 2013, which are hereby incorporated by reference herein in their entirety.

What is claimed is:

**1**. An apparatus comprising:

a cover including a protrusion; and

an abutment unit, capable of abutting the protrusion, including (i) a second member for applying a force to a first member of an image forming apparatus and (ii) a lifting portion for lifting the first member,

wherein the abutment unit includes a first surface which abuts the protrusion in a case where the cover is shifted from an opened state and a second surface which abuts the protrusion in a case where the cover is shifted to the closed state after having abutted the first surface, and

wherein the first and second surfaces are on one of end portions of the abutment unit, the lifting portion is on the other end portion, and a rotational fulcrum of the abutment unit is arranged between (i) the first and second surfaces and (ii) the lifting portion.

**2**. The apparatus of claim **1**, wherein the protrusion, the abutment unit and the first member are arranged toward an inside of the apparatus in this order.

**3**. The apparatus according to claim **1**, wherein the abutment unit is sandwiched between the protrusion and the first member.

**4**. The apparatus according to claim **1**, wherein the protrusion includes an intersecting surface that intersects with the second surface of the abutment unit when the cover is in the closed state, and the intersecting surface abuts the second surface of the abutment unit when the cover is in the closed state, so that the protrusion is applied a force from the rotational force of the abutment unit.

**5**. The apparatus according to claim **1**, wherein one end portion of the abutment unit includes the first surface on which the protrusion frictionally slides while abutting thereon and the second surface on which the protrusion abuts after having frictionally slid on the first surface.

**6**. The apparatus according to claim **1**, wherein the first member is any one of a storage medium access unit configured to access a storage medium, a laser shutter, a door switch, and a storage medium.

**7**. The apparatus according to claim **1**, wherein the abutment unit includes a lifting end portion for lifting the first member when the cover is shifted from the closed state to the opened state.

**8**. The apparatus according to claim **1**, wherein the cover has a convex shape toward outside the apparatus.

**9**. The apparatus according to claim **1**, wherein a process cartridge including an image bearing member is attachable to and detachable from the apparatus, and the storage medium is provided to the process cartridge.

**10**. The apparatus according to claim **1**, wherein a cleaning device is attachable to and detachable from the apparatus, and the storage medium is provided to the cleaning device.

**11**. The apparatus according to claim **1**, wherein a developing device including a developer bearing member is attachable to and detachable from the apparatus, and the storage medium is provided to the developing device.

**12**. An image forming apparatus capable of forming an image on a recording medium with a developer with use of an apparatus according to claim **1**.

**13**. The apparatus according to claim **1**, wherein the second member contacts with the first member when the cover is in the closed state.

**14**. The apparatus according to claim **1**, wherein the second member pushes the first member when the cover is in the closed state.

**15**. The apparatus according to claim **1**, wherein the abutment unit is sandwiched between the protrusion and the first member.

**16**. The apparatus according to claim **1**, wherein the protrusion, the abutment unit and the first member are arranged toward an inside of the apparatus in this order.

**17**. The apparatus according to claim **1**, wherein the protrusion has an inclined surface.

**18**. The apparatus according to claim **17**, wherein the inclined surface is inclined at 5° to 45°.

19. The apparatus according to claim 17, wherein the protrusion is applied an inclined force, which is inclined toward an inside of the apparatus, from a rotational force of the abutment unit when the inclined surface abuts the second surface, and the second member of the abutment unit applies a force to the first member when the cover is in the closed state.

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